

REMARKS/ARGUMENTS

Claims 1, 42-56 and 59-110 are pending. All claims have been rejected.

Claims 64-83 are rejected under 35 U.S.C. Section 112 as failing to comply with the written description requirement in the recitation in claim 64 that a film of a material is "substantially insoluble in organic liquids." This rejection is believed alleviated by the enclosed amendment of claim 64 deleting the objected – to phrase and characterizing the processed film as forming a "resist pattern". This is expressly disclosed in the third paragraph of the "Detailed Description Of The Invention" (pp. 6 and 7 of the application as filed). The solubility characterizations of resist patterns are known to those skilled in the art. (See paragraph 3 under "Background of the Art", pp. 1 and 2). Resists and other suitable materials are listed at p. 12, line 7 at seq. Accordingly, the written description requirement is met.

The Office Action also rejects all claims under 35 U.S.C. Section 103(a) as unpatentable over Napoli et al. alone or in view of European Patent Application No. 244,884. These rejections are respectfully traversed.

Applicant's claims are directed to a method of replicating patterns with unimaginably small features onto a substrate by a technique that has become known as nanoimprint lithography.

At the effective filing date of this case in 1998, the dominant method of replicating tiny patterns, as for fabrication of integrated circuits, was optical lithography. At that time, there was a need to replicate patterns with smaller and smaller features. But

optical lithography was encountering fundamental limitations relating to difficulties in replicating features smaller than the wavelength of the light used to project the feature and to difficulties in using light with wavelengths much smaller than visible light. As a consequence the integrated circuit industry was struggling with its next-generation goal of replicating patterns with 0.18 micron (180 nanometers) features.

Applicant discovered that much smaller patterns could be replicated on a substrate by imprinting with a molding surface. Specifically he discovered and disclosed in this case, that he could imprint, in a moldable surface, patterns having features 200 nanometers or smaller. Further processing of the moldable surface on an underlying substrate such as a silicon wafer could replicate the tiny mold pattern onto the substrate. This discovery permitted replication of patterns having features one-fourth to one-twentieth the size of state-of-the-art optical lithography (about 0.5 micrometers). Significantly, it also freed pattern replication from limitations due to the wavelength of light.

The Napoli et al reference cited in the Office Action relates to imprinting patterns. But Napoli et al. is devoid of any teaching or suggestion that one can replicate sub-200 nanometer features using imprint lithography. In Napoli the smallest exemplified feature is 0.7 micrometer (700 nanometers).

The Office Action is correct that Napoli asserted that a pattern master could have relief variations "as small as 0.6 micrometer" (600 nanometers). (See Col. 3, lines 37-48). But this was not set forth as a typical result. Rather, it was set forth by the words

"as small as". These words indicate that 600 nanometers was the lower limit of the process. Thus, Napoli provides no advance over the state-of-the-art 0.5 micrometer optical lithography (500 nanometers) and wholly fails to teach or suggest the sub-100 nanometer features of claim 1.

Furthermore, Napoli, et al. do not teach or suggest the steps that are necessary to imprint features smaller than about 600 nanometers. First, Napoli uses a thick resist (500 to 1,500 nanometers). It would require a lengthy etching to remove the thinner residual part of the imprinted resist. Such extensive etching would etch away laterally a significant part or the entirety of an imprinted sub-200 nanometer feature.

Second, Napoli uses a polymer release layer (PTFE) having a thickness of about 40 nanometers. Such a release layer would fill or distort fine mold features, preventing accurate replication of the fine sub-200 nanometer features claimed herein.

Third, Napoli's method is thermal embossing (Col. 3, lines 37-42). This is a process that heats a thermoplastic above its glass transition temperature and then imprints the thermoplastic. The plastic must then be cooled before separation from the mold so that the thermo plastic retains the imprint. The necessary heating and cooling produce thermal expansion differences among the components (e.g. the mold and the substrate) that prevent the replication of tiny nanoscale features. Napoli's nickel mold, for example, has a coefficient of thermal expansion much higher than silicon or silicon dioxide. The differential thermal contractions would smear sub-200 nanometer features.

The thermal effects also damage the mold and make it very difficult to align imprint patterns with existing patterns.

The secondary reference to EPA 244,884 is cited only for disclosure of a release material similar to the ones that Applicant uses. It does not recommend this material for lithography and does not address the more fundamental problems presented by Napoli's metal mold in thermal embossing.

In an attempt to overcome these deficiencies of Napoli, the Examiner argues that they were somehow overcome by the passage of 8 years between Napoli's issue date and Applicant's filing date. But it is people, not time, that make inventions.

This assertion that the mere passage of 8 years obviates the claimed invention is unsupported by prior art or documentary evidence. Moreover, should the assertion be based on the Examiner's personal knowledge or alleged common knowledge, the Office Action has not met the requirements for Official Notice are set forth in M.P.E.P. § 2144.03. The M.P.E.P. instructs:

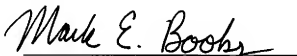
"Any rejection based on assertions that a fact is well-known or is common knowledge in the art without documentary evidence to support the examiner's conclusion should be judiciously applied. Furthermore, as noted by the court in Ahlert, any facts so noticed should be of notorious character and serve only to "fill in the gaps" in an insubstantial manner which might exist in the evidentiary showing made by the examiner to support a particular ground of rejection. It is never appropriate to rely solely on common knowledge in the art without evidentiary support in the record as principal evidence upon which a rejection was based.

Appl. No. 10/046,594
Amdt. dated January 10, 2008
Reply to Office action of July 10, 2007

If a rejection is based on alleged common knowledge or personal knowledge of the Examiner, then upon challenge by the applicant – which challenge is hereby made – the Examiner must provide documentary or affidavit evidence of the asserted facts. M.P.E.P. 2144.04 C. Accordingly, if the “passage of 8 years” argument is based on alleged common knowledge or the personal knowledge of the Examiner, Applicant respectfully requests an Affidavit and/or documentary evidence in compliance with M.P.E.P. § 2144. In the advance of such a showing, it is respectfully requested that the rejections under 35 U.S.C. Section 103(a) be withdrawn.

In view of the foregoing it is submitted that claims 1, 42-56, and 59-110 patentably distinguish from all cited art. Accordingly this application now fully complies with the provisions of 35 U.S.C. Section 103 and is now in condition for allowance. Reconsideration and favorable action in this regard is therefore earnestly solicited.

Respectfully Submitted,



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